

## ABSTRACT

The present invention applies to resonant optical power control device assemblies and methods relating thereto, and includes an alignment device preferably including one or more waveguide-alignment grooves, resonator alignment grooves, and alignment grooves for a second optical element including a modulator. One embodiment includes a transmission optical waveguide, a circumferential-mode optical resonator; and a second optical element, optionally including one or more of an optical modulator or a second transmission optical waveguide, and optionally including a modulator optical control element. In this embodiment, the alignment grooves reliably establish and stably maintain evanescent optical coupling between the optical elements positioned in such grooves. A method for assembling a resonant optical power control devices is also disclosed. The method includes: fabricating an alignment substrate having various alignment grooves; positioning and securing the various optical elements in their corresponding alignment grooves so that the resonator and the transmission optical waveguide are optically coupled (through close proximity and/or direct contact between them), and similarly optically coupling the resonator and any second optical element. Alignment grooves in the substrate and/or in one or more of the optical elements are fabricated at proper depths and positions and preferably with mating grooves and/or flanges to enable the optical coupling without extensive active alignment procedures. A modulator can alternatively be provided as an integral component of the resonator, directly on the resonator, or as a separate assembly positioned on and secured with respect to the alignment substrate. The modulator enables control of the resonator, which in turn controls the optical power transmitted through the transmission optical waveguide and/or the second optical element. Structures may also be provided for suppressing undesired optical modes and/or resonances associated with resonators and/or alignment structures on the optical fiber.